

This listing of claims will replace all prior versions,  
and listings, of claims in the application:

1 Claim 1 (cancelled)

1 Claim 2 (currently amended): Apparatus for use in a base  
2 station in an orthogonal frequency division multiplexing  
3 (OFDM) based spread spectrum multiple access wireless  
4 system comprising:

5 a sequence generator for generating one or more pilot  
6 tone hopping sequences each including pilot tones, said  
7 pilot tones each being generated at frequency and time  
8 instants in a time-frequency grid;

9 a waveform generator, responsive to said one or more  
10 pilot tone hopping sequences, for generating a waveform for  
11 transmission; and

12 ~~The invention as defined in claim 1~~

13 wherein each of said one or more pilot tone hopping  
14 sequences is a Latin Squares based pilot tone hopping  
15 sequence.

1 Claim 3-6 (cancelled)

1 Claim 7 (currently amended): Apparatus for use in a base  
2 station in an orthogonal frequency division multiplexing  
3 (OFDM) based spread spectrum multiple access wireless  
4 system comprising:

5 a sequence generator for generating one or more pilot  
6 tone hopping sequences each including pilot tones, said

7 pilot tones each being generated at frequency and time  
 8 instants in a time-frequency grid;  
 9 a waveform generator, responsive to said one or more  
 10 pilot tone hopping sequences, for generating a waveform for  
 11 transmission;  
 12 wherein said sequence generator generates each of  
 13 said one or more pilot tone hopping sequences in accordance  
 14 with  $S_i = \{f_0^{s_i}, f_1^{s_i}, \dots, f_k^{s_i}, \dots\}$ , for  $i = 1, \dots, N_{pil}$ ; and ~~The invention as~~  
 15 defined in claim 3  
 16 wherein  $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a  
 17 time instant index, "T", "a", "s<sub>i</sub>" and "d" are integer  
 18 constants, "p" is a prime constant, and "Z" is a  
 19 permutation operator.

1 Claim 8 (original): The invention as defined in claim 7  
 2 wherein said prescribed number of symbol intervals T is a  
 3 prime number.

1 Claim 9 (original): The invention as defined in claim 7  
 2 wherein each of said one or more pilot tone hopping  
 3 sequences generated includes a prime number of distinct  
 4 tones.

1 Claim 10 (currently amended): The invention as defined in  
 2 claim 7 wherein said permutation operator Z is defined on  
 3  $[\text{MIN}(0, d), \text{MAX}(N, -1, p-1+d)]$  and "N," is the total  
 4 number of tones in the system, p is a prime number of tones  
 5 and "d" is a ~~prescribed~~ frequency.

1 Claim 11 (currently amended): The invention as defined in  
 2 claim 7 wherein each of said one or more pilot tone hopping  
 3 sequences has a ~~prescribed~~ slope "a".

1 Claim 12 (original): The invention as defined in claim 11  
 2 wherein said slope "a" is unique to said base station among  
 3 one or more neighboring base stations.

1 Claim 13 (currently amended): Apparatus for use in a base  
 2 station in an orthogonal frequency division multiplexing  
 3 (OFDM) based spread spectrum multiple access wireless  
 4 system comprising:

5 a sequence generator for generating one or more pilot  
 6 tone hopping sequences each including pilot tones, said  
 7 pilot tones each being generated at frequency and time  
 8 instants in a time-frequency grid;

9 a waveform generator, responsive to said one or more  
 10 pilot tone hopping sequences, for generating a waveform for  
 11 transmission; and

12 ~~The invention as defined in claim 1~~

13 wherein said waveform generator generates a waveform

14 in accordance with  $\sum_{i=1}^{N_{pil}} C_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$ , where  $f_k^{S_i}$  are given by the

15 sequence  $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$ , for  $i=1, \dots, N_{pil}$ ,  $\Delta f$  is the basic  
 16 frequency spacing between adjacent tones,  $C_k^{S_i}$  is a known  
 17 symbol to be transmitted at the  $k^{th}$  symbol instant and tone  
 18  $f_k^{S_i}$ .

1 Claim 14 (original): The invention as defined in claim 13  
 2 wherein  $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a time

3 instant index, "T", "a", "s<sub>i</sub>" and "d" are integer constants,  
4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 15 (currently amended): Apparatus for use in a base  
2 station in an orthogonal frequency division multiplexing  
3 (OFDM) based spread spectrum multiple access wireless  
4 system comprising:

5 a sequence generator for generating one or more pilot  
6 tone hopping sequences each including pilot tones, said  
7 pilot tones each being generated at frequency and time  
8 instants in a time-frequency grid; and

9 a waveform generator, responsive to said one or more  
10 pilot tone hopping sequences, for generating a waveform for  
11 transmission. ~~The invention as defined in claim 1~~

12 wherein said waveform generator generates a waveform

13 in accordance with  $\sum_{i=1}^{N_{pil}} C_k^{S_i} \Gamma_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$ , where  $f_k^{S_i}$  are given by the  
14 sequence  $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$ , for  $i=1, \dots, N_{pil}$ ,  $\Delta f$  is the basic  
15 frequency spacing between adjacent tones,  $C_k^{S_i}$  is a known  
16 symbol to be transmitted at the  $k^{th}$  symbol instant and tone  
17  $f_k^{S_i}$ , and  $\Gamma_k^{S_i} = 1$ , if  $f_k^{S_i} \in [0, N_t - 1]$ , and  $\Gamma_k^{S_i} = 0$ , otherwise.

1 Claim 16 (original): The invention as defined in claim 15  
2 wherein  $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a time  
3 instant index, "T", "a", "s<sub>i</sub>" and "d" are integer constants,  
4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 17 (original): The invention as defined in claim 16  
2 wherein said waveform generator includes a transmitter for  
3 transmitting said pilot tones and wherein pilot tones in

4 phantom tone regions defined by  $[\text{MIN}(0, d), 0]$  and  $[N, -1,$   
 5  $\text{MAX}(N, -1, p-1+d)]$ , where " $N$ ," is the total number of tones  
 6 in the system,  $p$  is a prime number of tones and " $d$ " is a  
 7 prescribed frequency, are not transmitted.

1 Claim 18 (cancelled)

1 Claim 19 (currently amended): A method for use in a base  
 2 station in an orthogonal frequency division multiplexing  
 3 (OFDM) based spread spectrum multiple access wireless  
 4 system comprising the steps of:

5 generating one or more pilot tone hopping sequences  
 6 each including pilot tones, said pilot tones each being  
 7 generated at frequency and time instants in a  
 8 time-frequency grid; and

9 in response to said one or more pilot tone hopping  
 10 sequences, generating a waveform for transmission, The  
 11 method as defined in claim 18

12 wherein each of said one or more pilot tone hopping  
 13 sequences is a Latin Squares based pilot tone hopping  
 14 sequence.

1 Claim 20 - 23 (canceled)

1 Claim 24 (currently amended): A method for use in a base  
 2 station in an orthogonal frequency division multiplexing  
 3 (OFDM) based spread spectrum multiple access wireless  
 4 system comprising the steps of:

5 generating one or more pilot tone hopping sequences  
 6 each including pilot tones, said pilot tones each being

7 generated at frequency and time instants in a  
 8 time-frequency grid;  
 9 in response to said one or more pilot tone hopping  
 10 sequences, generating a waveform for transmission; and  
 11 wherein said step of generating one or more pilot tone  
 12 hopping sequences includes a step of generating each of  
 13 said one or more pilot tone hopping sequences in accordance  
 14 with  $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$ , for  $i = 1, \dots, N_{pil}$ , and ~~The method as~~  
 15 ~~defined in claim 20~~  
 16 wherein  $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a time  
 17 instant index, "T", "a", "s<sub>i</sub>" and "d" are integer constants,  
 18 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 25 (original): The method as defined in claim 24  
 2 wherein said prescribed number of symbol intervals  $T$  is a  
 3 prime number.

1 Claim 26 (original): The method as defined in claim 24  
 2 wherein said step of generating one or more pilot tone  
 3 hopping sequences includes a step of generating each of  
 4 said one or more pilot tone hopping sequences having a  
 5 prime number of distinct tones.

1 Claim 27 (currently amended): The method as defined in  
 2 claim 24 wherein said permutation operator  $Z$  is defined on  
 3  $[\text{MIN}(0, d), \text{MAX}(N_t - 1, p - 1 + d)]$  and " $N_t$ " is the total  
 4 number of tones in the system,  $p$  is a prime number of tones  
 5 and "d" is a ~~prescribed~~ frequency.

1 Claim 28 (currently amended): The method as defined in  
 2 claim 24 wherein said step of generating one or more pilot  
 3 tone hopping sequences includes a step of generating each  
 4 of said one or more pilot tone hopping sequences having a  
 5 ~~prescribed~~ slope "a".

1 Claim 29 (original): The method as defined in claim 28  
 2 wherein said slope "a" is unique to said base station among  
 3 one or more neighboring base stations.

AB  
Cont.  
 1 Claim 30 (currently amended): A method for use in a base  
 2 station in an orthogonal frequency division multiplexing  
 3 (OFDM) based spread spectrum multiple access wireless  
 4 system comprising the steps of:

5 generating one or more pilot tone hopping sequences  
 6 each including pilot tones, said pilot tones each being  
 7 generated at frequency and time instants in a  
 8 time-frequency grid;

9 in response to said one or more pilot tone hopping  
 10 sequences, generating a waveform for transmission; and The  
 11 ~~method as defined in claim 18~~

12 wherein said step of generating said waveform includes  
 13 a step of generating said waveform in accordance with

14  $\sum_{i=1}^{N_{pil}} C_k^{S_i} e^{2\pi f_k^{S_i} \Delta t}$ , where  $f_k^{S_i}$  are given by the sequence

15  $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$ , for  $i=1, \dots, N_{pil}$ , where  $\Delta f$  is the basic  
 16 frequency spacing between adjacent tones,  $C_k^{S_i}$  is a known  
 17 symbol to be transmitted at the  $k^{th}$  symbol instant and tone  
 18  $f_k^{S_i}$ .

1 Claim 31 (original): The method as defined in claim 30  
 2 wherein  $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a time  
 3 instant index, "T", "a", "s<sub>i</sub>" and "d" are integer constants,  
 4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 32 (currently amended): A method for use in a base  
 2 station in an orthogonal frequency division multiplexing  
 3 (OFDM) based spread spectrum multiple access wireless  
 4 system comprising the steps of:

5 generating one or more pilot tone hopping sequences  
 6 each including pilot tones, said pilot tones each being  
 7 generated at frequency and time instants in a  
 8 time-frequency grid;

9 in response to said one or more pilot tone hopping  
 10 sequences, generating a waveform for transmission; and ~~The~~  
 11 ~~method as defined in claim 18~~

12 wherein said step of generating said waveform includes  
 13 a step of generating said waveform in accordance with

14  $\sum_{i=1}^{N_{pil}} C_k^{s_i} \Gamma_k^{s_i} e^{2\pi j f_k^{s_i} \Delta t}$ , where  $f_k^{s_i}$  are given by the sequence

15  $S_i = \{f_0^{s_i}, f_1^{s_i}, \dots, f_k^{s_i}, \dots\}$ , for  $i=1, \dots, N_{pil}$ , where  $\Delta f$  is the basic  
 16 frequency spacing between adjacent tones,  $C_k^{s_i}$  is a known  
 17 symbol to be transmitted at the  $k^{th}$  symbol instant and tone  
 18  $f_k^{s_i}$ , and  $\Gamma_k^{s_i} = 1$ , if  $f_k^{s_i} \in [0, N_t - 1]$ , and  $\Gamma_k^{s_i} = 0$ , otherwise.

1 Claim 33 (original): The method as defined in claim 32  
 2 wherein  $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a time  
 3 instant index, "T", "a", "s<sub>i</sub>" and "d" are integer constants,  
 4 "p" is a prime constant, and "Z" is a permutation operator.



1 Claim 34 (original): The method as defined in claim 33  
2 further including a step of transmitting said pilot tones  
3 and wherein pilot tones in phantom tone regions defined by  
4  $[\text{MIN}(0, d), 0]$  and  $[N_i - 1, \text{MAX}(N_i - 1, p - 1 + d)]$ , where " $N_i$ ,"  
5 is the total number of tones in the system,  $p$  is a prime  
6 number of tones and " $d$ " is a prescribed frequency are not  
7 transmitted.

1 Claim 35 (cancelled)

13  
1 Claim 36 (currently amended): Apparatus for use in a base  
2 station in an orthogonal frequency division multiplexing  
3 (OFDM) based spread spectrum multiple access wireless  
4 system comprising:

5 means for generating one or more pilot tone hopping  
6 sequences each including pilot tones, said pilot tones each  
7 being generated at frequency and time instants in a  
8 time-frequency grid;

9 means, responsive to said one or more pilot tone  
10 hopping sequences, for generating a waveform for  
11 transmission; and ~~The invention as defined in claim 35~~

12 wherein each of said one or more pilot tone hopping  
13 sequences is a Latin Squares based pilot tone hopping  
14 sequence.

1 Claim 37 -40 (canceled)

1 Claim 41 (currently amended): Apparatus for use in a base  
2 station in an orthogonal frequency division multiplexing  
3 (OFDM) based spread spectrum multiple access wireless  
4 system comprising:

5 means for generating one or more pilot tone hopping  
 6 sequences each including pilot tones, said pilot tones each  
 7 being generated at frequency and time instants in a  
 8 time-frequency grid; and

9 means, responsive to said one or more pilot tone  
 10 hopping sequences, for generating a waveform for  
 11 transmission,

12 wherein said step of generating one or more pilot tone  
 13 hopping sequences includes a step of generating each of  
 14 said one or more pilot tone hopping sequences in accordance  
 15 with  $S_i = \{f_0^{s_i}, f_1^{s_i}, \dots, f_k^{s_i}, \dots\}$ , for  $i=1, \dots, N_{pt}$ , and

16 ~~The invention as defined in claim 37 wherein~~  
 17  $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a time instant  
 18 index, "T", "a", "s<sub>i</sub>" and "d" are integer constants, "p" is  
 19 a prime constant, and "Z" is a permutation operator.

1 Claim 42 (original): The invention as defined in claim 41  
 2 wherein said prescribed number of symbol intervals T is a  
 3 prime number.

1 Claim 43 (original): The invention as defined in claim 41  
 2 wherein said means for generating one or more pilot tone  
 3 hopping sequences includes means for generating each of  
 4 said one or more pilot tone hopping sequences having a  
 5 prime number of distinct tones.

1 Claim 44 (original): The invention as defined in claim 41  
 2 wherein said permutation operator Z is defined on  $[\text{MIN}(0,$   
 3  $d), \text{MAX}(N_i - 1, p - 1 + d)]$  and " $N_i$ " is the total number of

4 tones in the system,  $p$  is a prime number of tones and " $d$ "  
5 is a prescribed frequency.

1 Claim 45 (currently amended): The invention as defined in  
2 claim 41 wherein said means for generating one or more  
3 pilot tone hopping sequences includes means for generating  
4 each of said one or more pilot tone hopping sequences  
5 having a ~~prescribed~~ slope " $a$ ".

1 Claim 46 (original): The invention as defined in claim 45  
2 wherein said slope " $a$ " is unique to said base station among  
3 one or more neighboring base stations.

1 Claim 47 (currently amended): Apparatus for use in a base  
2 station in an orthogonal frequency division multiplexing  
3 (OFDM) based spread spectrum multiple access wireless  
4 system comprising:

5 means for generating one or more pilot tone hopping  
6 sequences each including pilot tones, said pilot tones each  
7 being generated at frequency and time instants in a  
8 time-frequency grid;

9 means, responsive to said one or more pilot tone  
10 hopping sequences, for generating a waveform for  
11 transmission; and

1 ~~The invention as defined in claim 35~~

2 wherein said means for generating said waveform  
3 includes means for generating said waveform in accordance

4 with  $\sum_{i=1}^{N_{pil}} C_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$ , where  $f_k^{S_i}$  are given by the sequence

5  $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$ , for  $i=1, \dots, N_{pil}$ , where  $\Delta f$  is the basic

6 frequency spacing between adjacent tones,  $C_k^{S_i}$  is a known  
 7 symbol to be transmitted at the  $k^{\text{th}}$  symbol instant and tone  
 8  $f_k^{S_i}$ .

1 Claim 48 (original): The invention as defined in claim 47  
 2 wherein  $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a time  
 3 instant index, "T", "a", " $s_i$ " and "d" are integer constants,  
 4 "p" is a prime constant, and "Z" is a permutation operator.

13 *AB Cont.*  
 1 Claim 49 (currently amended): Apparatus for use in a base  
 2 station in an orthogonal frequency division multiplexing  
 3 (OFDM) based spread spectrum multiple access wireless  
 4 system comprising:

5 means for generating one or more pilot tone hopping  
 6 sequences each including pilot tones, said pilot tones each  
 7 being generated at frequency and time instants in a time-  
 8 frequency grid;

9 means, responsive to said one or more pilot tone  
 10 hopping sequences, for generating a waveform for  
 11 transmission; and

12 ~~The invention as defined in claim 35~~

13 wherein said means for generating said waveform  
 14 includes means for generating said waveform in accordance

15 with  $\sum_{i=1}^{N_{pil}} C_k^{S_i} \Gamma_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$ , where  $f_k^{S_i}$  are given by the sequence

16  $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$ , for  $i=1, \dots, N_{pil}$ , where  $\Delta f$  is the basic

17 frequency spacing between adjacent tones,  $C_k^{S_i}$  is a known

18 symbol to be transmitted at the  $k^{\text{th}}$  symbol instant and tone

19  $f_k^{S_i}$ , and  $\Gamma_k^{S_i} = 1$ , if  $f_k^{S_i} \in [0, N_t - 1]$ , and  $\Gamma_k^{S_i} = 0$ , otherwise.

1 Claim 50 (original): The invention as defined in claim 49  
2 wherein  $f_k^s = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$ , where "k" is a time  
3 instant index, "T", "a", " $s_i$ " and "d" are integer constants,  
4 "p" is a prime constant, and "Z" is a permutation operator.

*Art.*  
1 Claim 51 (original): The invention as defined in claim 50  
2 further including means for transmitting said pilot tones  
3 and wherein pilot tones in phantom tone regions defined by  
4  $[\text{MIN}(0, d), 0]$  and  $[N_t - 1, \text{MAX}(N_t - 1, p - 1 + d)]$ , where " $N_t$ ,"  
5 is the total number of tones in the system, p is a prime  
6 number of tones and "d" is a prescribed frequency are not  
7 transmitted.

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